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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Yoshihito MAENO et al.

Serial No.: 10/583,880 Group Art Unit:

Filed: June 21, 2006 Examiner:

For: PHOTOSENSITIVE COMPOSITION FOR VOLUME HOLOGRAM RECORDING

THE COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDED CLAIMS

1-8. (cancelled)

9. (new) A method of producing a volume hologram, wherein a hologram recording portion comprising a photosensitive composition for volume hologram recording containing a photopolymerizable compound as a refractive index modulation component, a photopolymerization initiator and a sensitizing dye which increases sensitivity of the photopolymerization initiator with respect to a wavelength of a visible region is subject to interference exposure using a predetermined volume hologram recording wavelength set in a visible region so as to record the volume hologram, and wherein the sensitizing dye has absorption at the volume hologram recording wavelength and a maximum absorption wavelength of the sensitizing dye deviates by 14 nm or more from the volume hologram recording wavelength.

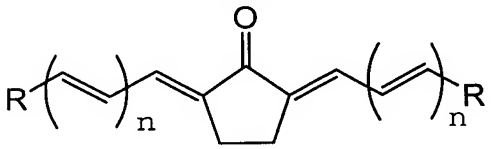
10. (new) A method of producing a volume hologram according to Claim 9, wherein the photosensitive composition for volume hologram recording further contains a binder resin and/or a thermosetting compound.

11. (new) A method of producing a volume hologram according to Claim 9, wherein the photopolymerizable compound is at least one kind selected from the group consisting of a photoradical polymerizable compound and a photocationic polymerizable compound.

12. (new) A method of producing a volume hologram according to Claim 9, wherein the photosensitive composition for volume hologram recording further contains a second refractive index modulation component having different refractive index from the photopolymerizable compound.

13. (new) A method of producing a volume hologram according to Claim 9, wherein the sensitizing dye is a cyclopentanone skeleton containing compound represented by the following general formula (1):

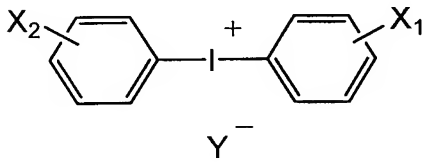
General formula (1):



wherein, "R" is a carbon-nitrogen containing substituent represented by "N_xC_y" in which x=1 to 4, y=8 to 30; "R" may contain a hydrogen atom and/or a halogen atom; "n" is an integer of 0 to 3.

14. (new) A method of producing a volume hologram according to Claim 9, wherein the photopolymerization initiator is a compound containing diaryliodonium skeleton represented by the following general formula (2):

General formula (2):

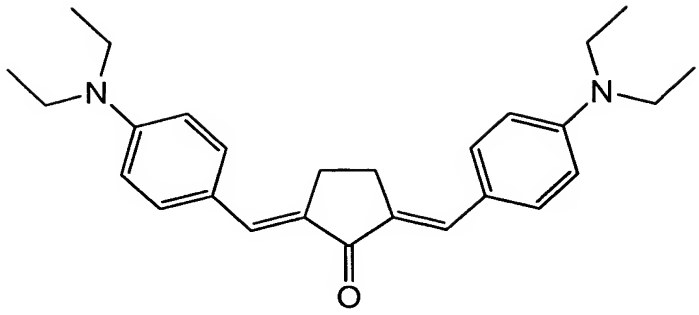


wherein, each of "X_1" and "X_2" is independently an alkyl group having 1 to 20 carbons, halogen or an alkoxyl group having 1 to 20 carbons; "Y^-" is a monovalent anion.

15. (new) A method of producing a volume hologram according to Claim 9, wherein the maximum absorption wavelength of the sensitizing dye deviates by 14 nm or more with respect to a predetermined volume hologram recording wavelength set within a region of 514 nm to 560 nm.

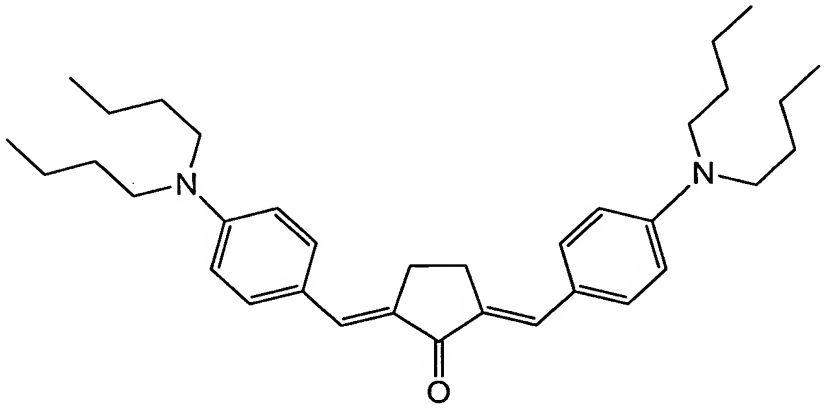
16. (new) A method of producing a volume hologram according to Claim 15, wherein the volume hologram recording wavelength is set within a region of 514 nm to 560 nm and the sensitizing dye is selected from a group consisting of the following compounds (3) and (4):

Compound (3):



Chemical name: 2,5-bis(4-diethylaminobenzylidene)cyclopentanone;

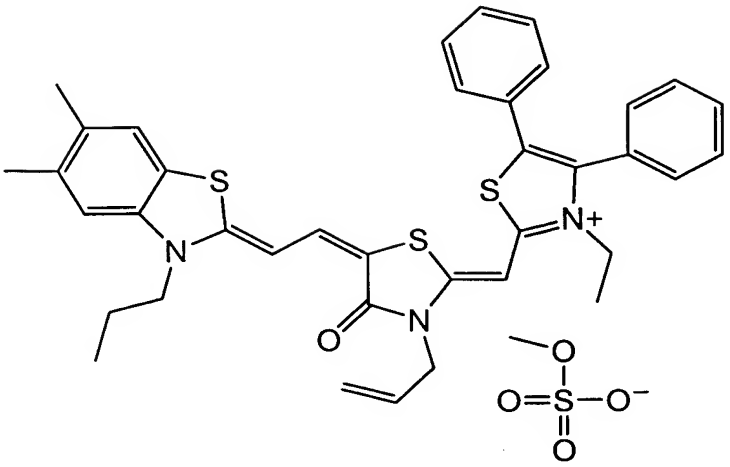
Compound (4):



Chemical name: 2,5-bis(4-dibutylaminobenzylidene)cyclopentanone.

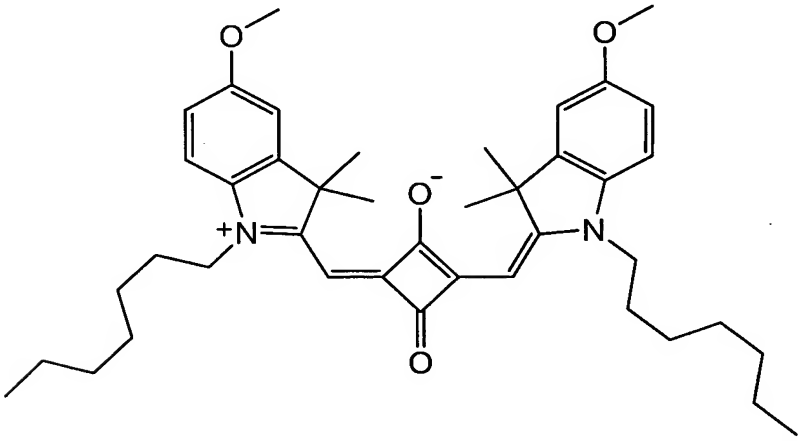
17. (new) A method of producing a volume hologram according to Claim 9, wherein the volume hologram recording wavelength is set within a region of 630 nm to 670 nm and the sensitizing dye is selected from a group consisting of the following compounds (1) and (2):

Compound (1):



Chemical name: 2-[[3-allyl-5-[2-(5,6-dimethyl-3-propyl-2(3H)-benzothiazolylidene)ethylidene]-4-oxo-2-thiazolidinylidene] methyl]-3-ethyl-4,5-diphenylthiazolium methylsulfate;

Compound (2):

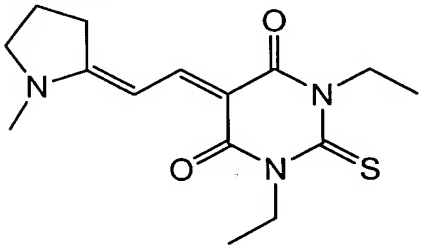


Chemical name: 1-heptyl-2-[3-(1-heptyl-5-methoxy-3,3-dimethyl-1,3-dihydro-indole-2-ilidenemethyl)-2-hydroxy-4-oxo-2-cyclobutenylidenemethyl]-5-methoxy-3,3-dimethyl-3H-indolium inner salt.

18. (new) A method of producing a volume hologram according to Claim 9, wherein the volume hologram recording wavelength is set within a region of 420

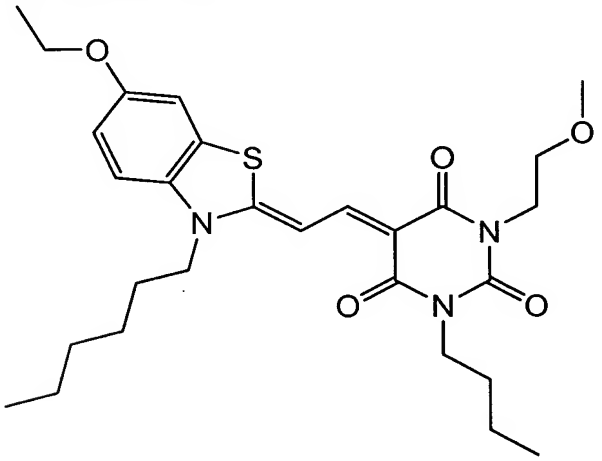
nm to 488 nm and the sensitizing dye is selected from a group consisting of the following compounds (5) and (6):

Compound (5):



Chemical name: 1,3-diethyl-5-[2-(1-methyl-pyrrolidine-2-ilidene)-ethylidene]-2-thioxo-dihydro-pyrimidine-4,6-dione;

Compound (6):

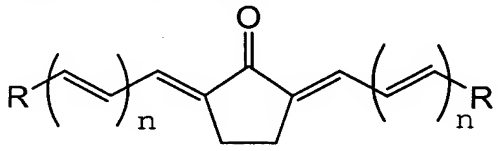


Chemical name: 1-butyl-5-[2-(6-ethoxy-3-hexyl-3H-benzothiazole-2-ilidene)-ethylidene]-3-(2-methoxy-ethyl)-pyrimidine-2,4,6-trione.

19. (new) A method of producing a volume hologram according to Claim 9, wherein a volume hologram having a diffraction efficiency of 80 % or more can be obtained.

20. (new) A photosensitive composition for volume hologram recording comprising a photopolymerizable compound as a refractive index modulation component, a photopolymerization initiator, a sensitizing dye which increases sensitivity of the photopolymerization initiator with respect to a wavelength of a visible region and a binder resin and/or a thermosetting compound, wherein the composition itself has absorption at a predetermined volume hologram recording wavelength set in a visible region and the sensitizing dye is a cyclopentanone skeleton containing compound represented by the following general formula (1):

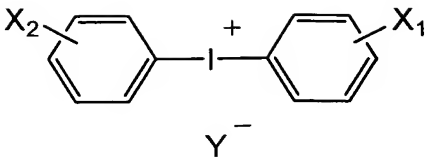
General formula (1):



wherein, "R" is a carbon-nitrogen containing substituent represented by "N_xC_y" in which x=1 to 4, y=8 to 30; "R" may contain a hydrogen atom and/or a halogen atom; "n" is an integer of 0 to 3.

21. (new) A photosensitive composition for volume hologram recording according to Claim 20, wherein the photopolymerization initiator is a compound containing diaryliodonium skeleton represented by the following general formula (2):

General formula (2):



wherein, each of "X_1" and "X_2" is independently an alkyl group having 1 to 20 carbons, halogen or an alkoxyl group having 1 to 20 carbons; "Y^-" is a monovalent anion.

22. (new) A photosensitive composition for volume hologram recording according to Claim 20, wherein the photopolymerizable compound is at least one kind selected from the group consisting of a photoradical polymerizable compound and a photocationic polymerizable compound.

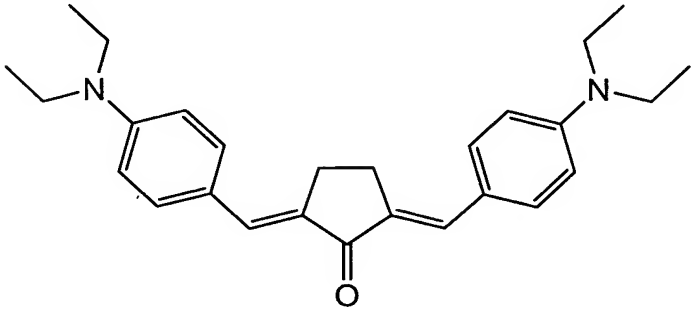
23. (new) A photosensitive composition for volume hologram recording according to Claim 20, wherein the photosensitive composition for volume hologram recording further contains a second refractive index modulation component having different refractive index from the photopolymerizable compound.

24. (new) A photosensitive composition for volume hologram recording according to Claim 20, wherein a volume hologram having a diffraction efficiency of 80 % or more can be obtained.

25. (new) A photosensitive composition for volume hologram recording comprising a photopolymerizable compound as a refractive index modulation component, a photopolymerization initiator, a sensitizing dye which increases sensitivity of the photopolymerization initiator with respect to a wavelength of a visible region and a binder resin and/or a thermosetting compound, wherein the composition itself has absorption at a predetermined volume hologram recording

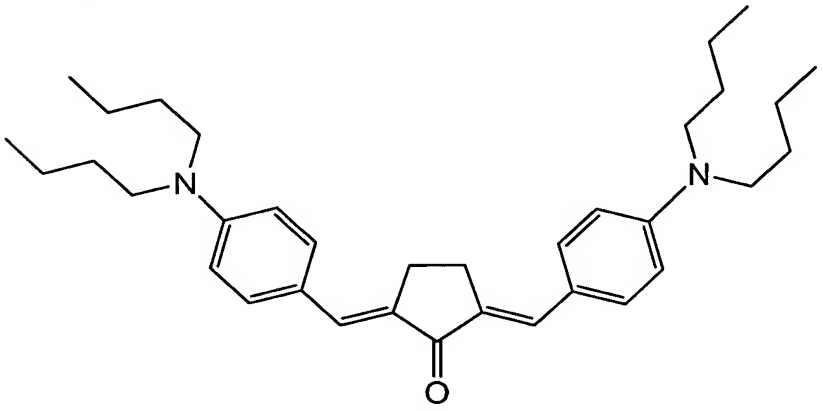
wavelength set within a region of 514 nm to 560 nm and the sensitizing dye is selected from a group consisting of the following compounds (3) and (4):

Compound (3):



Chemical name: 2,5-bis(4-diethylaminobenzylidene)cyclopentanone;

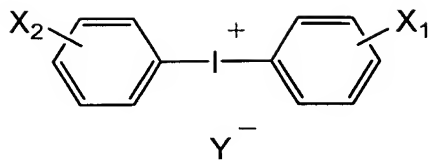
Compound (4):



Chemical name: 2,5-bis(4-dibutylaminobenzylidene)cyclopentanone.

26. (new) A photosensitive composition for volume hologram recording according to Claim 25, wherein the photopolymerization initiator is a compound containing diaryliodonium skeleton represented by the following general formula (2):

General formula (2):



wherein, each of "X_1" and "X_2" is independently an alkyl group having 1 to 20 carbons, halogen or an alkoxyl group having 1 to 20 carbons; "Y^-" is a monovalent anion.

27. (new) A photosensitive composition for volume hologram recording according to Claim 25, wherein the photopolymerizable compound is at least one kind selected from the group consisting of a photoradical polymerizable compound and a photocationic polymerizable compound.

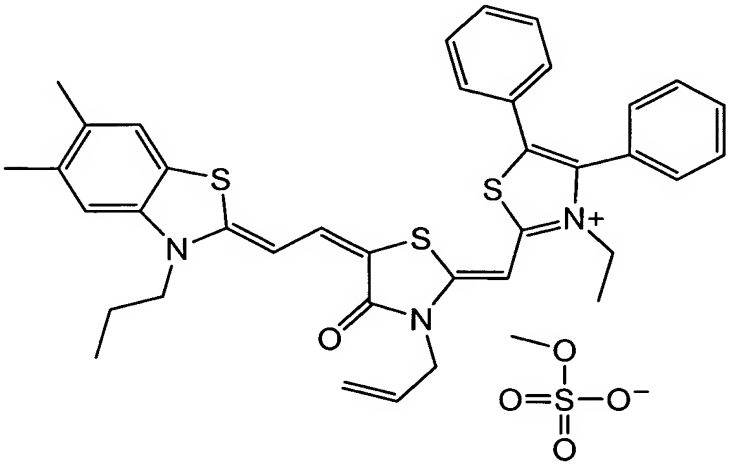
28. (new) A photosensitive composition for volume hologram recording according to Claim 25, wherein the photosensitive composition for volume hologram recording further contains a second refractive index modulation component having different refractive index from the photopolymerizable compound.

29. (new) A photosensitive composition for volume hologram recording according to Claim 25, wherein a volume hologram having a diffraction efficiency of 80 % or more can be obtained.

30. (new) A photosensitive composition for volume hologram recording comprising a photopolymerizable compound as a refractive index modulation component, a photopolymerization initiator, a sensitizing dye which increases sensitivity of the photopolymerization initiator with respect to a wavelength of a

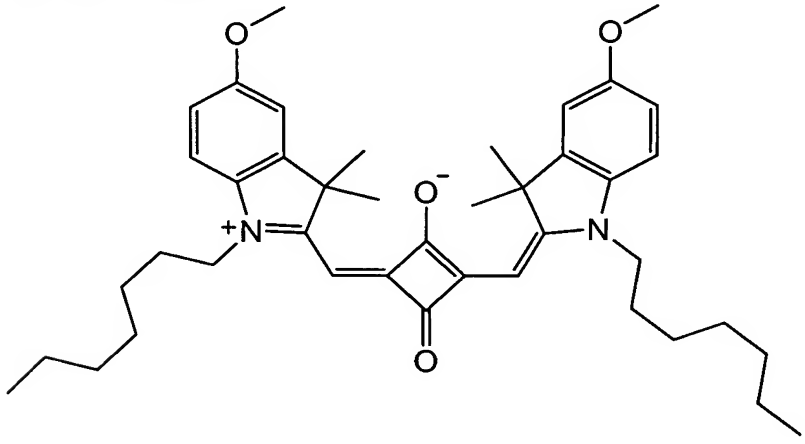
visible region and a binder resin and/or a thermosetting compound, wherein the composition itself has absorption at a predetermined volume hologram recording wavelength set within a region of 630 nm to 670 nm and the sensitizing dye is selected from a group consisting of the following compounds (1) and (2):

Compound (1):



Chemical name: 2-[[3-allyl-5-[2-(5,6-dimethyl-3-propyl-2(3H)-benzothiazolylidene)ethylidene]-4-oxo-2-thiazolidinylidene] methyl]-3-ethyl-4,5-diphenylthiazolium methylsulfate;

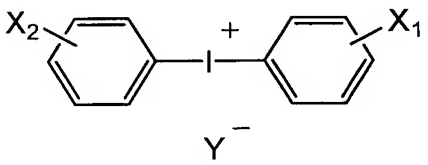
Compound (2):



Chemical name: 1-heptyl-2-[3-(1-heptyl-5-methoxy-3,3-dimethyl-1,3-dihydro-indole-2-ilidenemethyl)-2-hydroxy-4-oxo-2-cyclobutenylidenemethyl]-5-methoxy-3,3-dimethyl-3H-indolium inner salt.

31. (new) A photosensitive composition for volume hologram recording according to Claim 30, wherein the photopolymerization initiator is a compound containing diaryliodonium skeleton represented by the following general formula (2):

General formula (2):



wherein, each of "X_1" and "X_2" is independently an alkyl group having 1 to 20 carbons, halogen or an alkoxyl group having 1 to 20 carbons; "Y^-" is a monovalent anion.

32. (new) A photosensitive composition for volume hologram recording according to Claim 30, wherein the photopolymerizable compound is at least one kind selected from the group consisting of a photoradical polymerizable compound and a photocationic polymerizable compound.

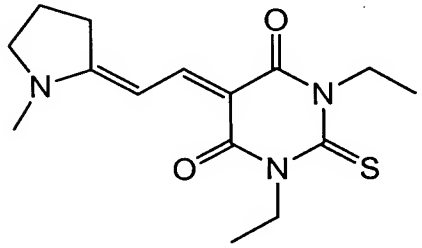
33. (new) A photosensitive composition for volume hologram recording according to Claim 30, wherein the photosensitive composition for volume hologram recording further contains a second refractive index modulation

component having different refractive index from the photopolymerizable compound.

34. (new) A photosensitive composition for volume hologram recording according to Claim 30, wherein a volume hologram having a diffraction efficiency of 80 % or more can be obtained.

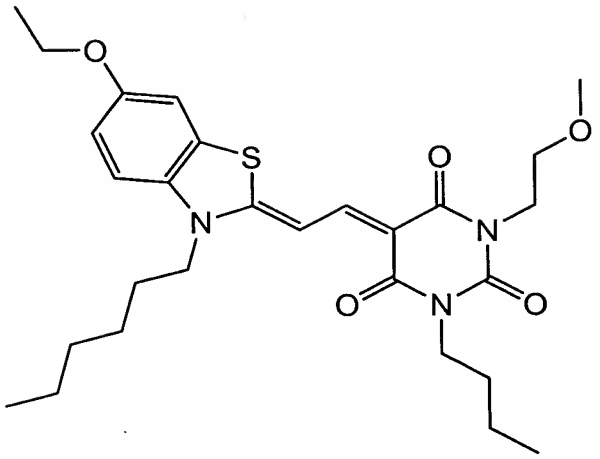
35. (new) A photosensitive composition for volume hologram recording comprising a photopolymerizable compound as a refractive index modulation component, a photopolymerization initiator, a sensitizing dye which increases sensitivity of the photopolymerization initiator with respect to a wavelength of a visible region and a binder resin and/or a thermosetting compound, wherein the composition itself has absorption at a predetermined volume hologram recording wavelength set within a region of 420 nm to 488 nm and the sensitizing dye is selected from a group consisting of the following compounds (5) and (6):

Compound (5):



Chemical name: 1,3-diethyl-5-[2-(1-methyl-pyrrolidine-2-ilidene)-ethylidene]-2-thioxo-dihydro-pyrimidine-4,6-dione;

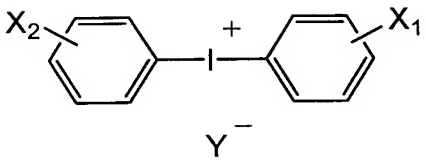
Compound (6):



Chemical name: 1-butyl-5-[2-(6-ethoxy-3-hexyl-3H-benzothiazole-2-ilidene)-ethylidene]-3-(2-methoxy-ethyl)-pyrimidine-2,4,6-trione.

36. (new) A photosensitive composition for volume hologram recording according to Claim 35, wherein the photopolymerization initiator is a compound containing diaryliodonium skeleton represented by the following general formula (2):

General formula (2):



wherein, each of "X_1" and "X_2" is independently an alkyl group having 1 to 20 carbons, halogen or an alkoxyl group having 1 to 20 carbons; "Y^-" is a monovalent anion.

37. (new) A photosensitive composition for volume hologram recording according to Claim 35, wherein the photopolymerizable compound is at least one

kind selected from the group consisting of a photoradical polymerizable compound and a photocationic polymerizable compound.

38. (new) A photosensitive composition for volume hologram recording according to Claim 35, wherein the photosensitive composition for volume hologram recording further contains a second refractive index modulation component having different refractive index from the photopolymerizable compound.

39. (new) A photosensitive composition for volume hologram recording according to Claim 35, wherein a volume hologram having a diffraction efficiency of 80 % or more can be obtained.